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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/228,694	01/12/99	PANDYA A	50353

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EXAMINER	
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ART UNIT	**PAPER NUMBER**
1752	9

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Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.	Applicant(s)
09/228,694	Pandya et al.
Examiner	**Group Art Unit**
Sin J. Lee	1752

☒ Responsive to communication(s) filed on *May 1, 2000*

☐ This action is **FINAL.**

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire *three* month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claim

☒ Claim(s) *1-34* is/are pending in the applicat

Of the above, claim(s) _____ is/are withdrawn from consideration

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) *1-34* is/are rejected.

☒ Claim(s) *28* is/are objected to.

☐ Claims _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☐ All ☐ Some* ☒ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) _____.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

☒ Notice of References Cited, PTO-892

☒ Information Disclosure Statement(s), PTO-1449, Paper No(s). *8*

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

— SEE OFFICE ACTION ON THE FOLLOWING PAGES —

1. Claim 28 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. In claim 28, applicants recite "wherein W comprises an acid-labile group;". However, the claim 28 depends from claim 24, which is claiming a polymer that comprises an *acrylate* acid labile group. Since W (claimed in claim 28) is an acid-labile group which is broader in scope than an *acrylate* acid labile group (claimed in claim 24), the claim 28 fails to further limit the subject matter of the claim 24.

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 23, 27, and 29 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 23, which depends from the claim 20, recites the limitation "z" in the first line. There is insufficient antecedent basis for this limitation in the claim (i.e., the claim 20 does not have variable z in the formula IV.

Claim 27 recites, ". . . wherein the sum of w, x and y is at least about 90 percent." Also, claim 29 recites, ". . . wherein the sum of w', x', y' and z' is at least about 90 percent." It is unclear upon what the sum of 90 percent is based. Is the sum of 90 percent based on the total

units of the polymer or on something else? Also, do applicants mean 90 mole percent or 90 percent by weight? Appropriate correction or clarification is required.

For the purpose of examining the claims 27 and 29 on the merit, the Examiner assumed that applicants meant to claim the sum of w, x and y (and the sum of w', x', y' and z') being at least about 90 mole percent of total units of the polymer (just as in present claim 5).

4. Due to newly cited prior arts, the following rejections are made non-final.

5. Claims 1-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe et al (5,844,057).

Watanabe et al teach a chemically amplified positive resist composition containing a polymer having recurring units of hydroxyphenyl groups and acid labile group and a photoacid generator. See particularly, col.2, lines 8-25, col.5, lines 24-67, col.6, lines 1-26, lines 43-45, lines 61-67, col.7, lines 60-65, col.19, lines 29-51.

With respect to present claims 1, 2, 10, 11, 17, 20, 22, 24, and 34, in the formula (3) shown in col.6 of the prior art, it is indicated that the hydroxyl group can be located anywhere on the phenyl ring of the second repeating unit (the one denoted by the mole fraction variable q), which means that the hydroxyl group can be located at the meta, para *or* ortho position of the phenyl ring. Also, the variable m can be 1, 2, *or* 3. Therefore, it would have been obvious to one having ordinary skill in the art that some of the recurring units would have a single meta-hydroxy group on the phenyl ring and some other recurring units would have a single para-hydroxy group on the phenyl ring. Also for the last repeating unit in the same formula, R^5 can be -COOX

wherein X is a hydrogen or acid labile group. As examples of the acid labile group, Watanabe et al list six examples one of which is a normal, branched or cyclic alkyl groups of 1-6 carbon atoms (see col.6, lines 21-26), and as specific examples for the normal and branched alkyl groups, the prior art lists seven examples one of which is a tert-butyl group (see col.6, lines 42-45). Since there are only six examples for the acid labile group, it would have been obvious to one of ordinary skill in the art to choose (as a matter of choice) the normal, branched or cyclic alkyl groups of 1-6 carbon atoms to be the acid labile group, i.e., X in the -COOX moiety with a reasonable expectation of achieving a resist components improved in sensitivity, resolution, and latitude of exposure. Also, since there are only seven examples for the normal, branched or cyclic alkyl groups of 1-6 carbon atoms, it would have been obvious to one of ordinary skill in the art to choose (as a matter of choice) a tert-butyl group to be the X in the -COOX moiety with a reasonable expectation of achieving a resist components improved in sensitivity, resolution, and latitude of exposure. When X is a tert-butyl group, then the R^5 in the last repeating unit of the formula (3) becomes -COO-(t-butyl), and the last repeating unit becomes the presently claimed acrylate acid-labile groups. Therefore, the prior art's polymer of the formula (3) would encompass the presently claimed polymer comprising an acrylate acid-labile group, a metahydroxyphenyl group, and a para-hydroxyphenyl group.

With respect to present claims 3, 6, 18, 21, 25, and 26, since the present variable n of these claims can be zero (and the present variable m of the claim 25 can also be zero), the prior

art's polymer of the formula (3) also teaches the presently claimed polymers of the claims 3, 6, 18, 21, 25 and 26 as explained above.

With respect to the presently claimed S group-containing repeating unit in claims 8 and 28, the formula (3) shown in col.6 of the prior art indicates that R^3 of the $-OR^3$ group attached to the phenyl ring of the third repeating unit is an acid labile group. As the preferred examples for the acid labile group, Watanabe et al list six examples one of which is normal, and branched alkyl groups such as methyl, ethyl, propyl, isopropyl, n-butyl, iso-butyl, and tert-butyl groups. Since there are only six categories of acid labile group examples listed by Watanabe et al, it would have been obvious for one having ordinary skill in the art to choose (as a matter of choice) normal, and branched alkyl groups such as methyl, ethyl, propyl, isopropyl, n-butyl, iso-butyl, and tert-butyl groups to be the acid labile group, R^3, with a reasonable expectation of achieving the chemically amplified positive resist composition which is improved in sensitivity, resolution, latitude of exposure, and process adaptability over the conventional resist compositions. Applicants state on page 10 of the present specification that the suitable S groups include aromatic groups such as phenyl and that the phenyl group is optionally substituted with non-reactive groups such as alkoxy group. Therefore, the prior art, which says that $-OR^3$ attached to the phenyl ring can be methoxy, ethoxy, propoxy, isopropoxy, n-butoxy, iso-butoxy, and tert-butoxy (all of which are alkoxy groups), teaches the presently claimed S-group containing repeating unit.

With respect to present claims 5, 7, 12, 19, 23, and 27, Watanabe et al teach in col.7, lines 60-65 that the mole fraction of q (the repeating units that contain hydroxy groups) would be 0.2-0.95 whereas the mole fraction of s (the repeating units that contain acid labile group) would be 0-0.5. If one arbitrarily picks 0.9 for the mole fraction q and 0.05 for the mole fraction s, this will give the sum of q and s to be 0.95 (which is 95 mole %). Since this number overlaps with the presently claimed range of at least about 90 mole %, the prior art's teaching would have made the present range *prima facie* obvious. In the case "where the [claimed] ranges overlap or lie inside ranges disclosed by the prior art," a *prima facie* case of obviousness would exist which may be overcome by a showing of unexpected results, In re Wertheim, 541 F.2d 257, 191 USPQ 90 (CCPA 1976)

With respect to present claims 9 and 29, Watanabe et al teach in col.7, lines 60-65 that the mole fraction of t to be 0.05-0.8 which will give the sum of q, r, and s to be 0.2-0.95. Since the prior art range of 0.2-0.95 (20-95 mole %) overlaps with the present range of at least about 90%, the prior art's range would have made the present range *prima facie* obvious. See In re Wertheim, supra.

With respect to present claims 13-16 and 30-33, Watanabe et al teach in col.19, lines 29-39 that their resist composition (including the resin and the photoacid generator) is spin-coated onto a *silicon wafer*, exposed to actinic radiation, and developed to form a resist pattern. Therefore, the prior art teaches the present inventions of these claims. Especially, since applicants state on page 17 of the present specification that the composition may be applied over

silicon or silicon dioxide wafers for the production of *microprocessors* and other integrated circuit components, the prior art teaches the presently claimed substrate being the microelectronic wafer.

6. Claims 1-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Urano et al (EP 0 780 732 A2).

Urano et al teach a composition comprising a polymer (b) represented by the formula [2] (shown on pg.7) and a substance which generates an acid on exposure to actinic radiation. The prior art also teaches a pattern forming process which comprises applying its resist material on a semiconductor substrate (such as a silicone wafer), exposing it to actinic radiation through a mask, and conducting development, and the prior art teaches the present inventions of the claims 1-34. See particularly, pg.5, lines 14-20, lines 28-29, lines 37-39, pg.6, lines 14-16, pg.7, lines 1-13, lines 45-50, pg.8, lines 4-6, pg.12, lines 14-17, pg.24, lines 58, pg.25, lines 1-3, lines 8-10, lines 12-17.

With respect to present claims 1, 17, 24 and 34, Urano et al's polymer (b) which is represented by the formula [2] shown on pg.7 contains a single -OH substituted styrene repeating units. Since the formula does not restrict the position of the hydroxy group on the phenyl ring, it is the Examiner's position that some of the styrene repeating units could have the single hydroxy group on the meta position (and unsubstituted at other ring positions as presently claimed) and the rest of the styrene repeating units could have the single hydroxy group on the para position. Therefore, it is the Examiner's position that the prior art's formula for the polymer (b)

encompasses a polymer having meta-hydroxyphenyl group and a para-hydroxyphenyl group which is presently claimed. In the third repeating unit in Urano et al's polymer (b), R^{21} is H atom or a lower alkyl group and R^{22} can be a *carboxyl group which may be esterified*, a cyano group or a phenyl group which may have one or more substituents. As examples for the *carboxyl group which may be esterified*, Urano et al teach methoxycarbonyl, ethoxycarbonyl, propoxycarbonyl, *butoxycarbonyl*, pentyloxycarbonyl and hexyloxycarbonyl. First of all, since there are only three kinds of example for the R^{22}, it would have been obvious to one of ordinary skill in the art to choose a carboxyl group which may be esterified (as a matter of choice) to be R^{22} with a reasonable expectation of achieving a resist material suitable for forming a pattern excellent in sensitivity, resolution , mask linearity and other properties. Second of all, since there are only six examples given for the carboxyl group which may be esterified, it would have been obvious to one of ordinary skill in the art to choose (as a matter of choice) the butoxycarbonyl group (an acid-labile group) to be the carboxyl group which may be esterified for the R^{22} with a reasonable expectation of achieving a resist material excellent in sensitivity, resolution, mask linearity and other properties, *and when the R^{22} of the formula [2] is butoxycarbonyl group, the prior art's third repeating unit teaches the presently claimed acrylate acid-labile groups*. Therefore, the prior art's formula [2] teaches the presently claimed polymer comprising an acid-labile group, a meta-hydroxyphenyl group and a para-hydroxyphenyl group.

With respect to present claims 3, 6, 18 and 25, since the present variable n of these claims can be zero, and the present variable m of the claim 25 can be zero also, the prior art's polymer having the formula [2] teaches the present inventions of these claims as explained above.

With respect to present claims 8 and 28, the prior art's polymer of formula [2] teaches the presently claimed repeating unit having the S group. In the prior art's formula [2], the first repeating unit (the one with the R^7-substituted phenyl group), R^7 can be a H atom, a lower alkyl group, a lower alkoxy group, an acyloxy group, a saturated heterocyclic oxy group, or R^8O-CO-(CH_2)-O- (see pg.6, lines 14-16). Since there are only six examples for the R^7 group, it would have been obvious to one of ordinary skill in the art to choose (as a matter of choice) a lower alkyl group or a lower alkoxy group to be the R^7 with a reasonable expectation of achieving a resist material excellent in sensitivity, resolution, mask linearity and other properties. On pg.10, lines 13-14 of the present specification, applicants state that a phenyl group optionally substituted with non-reactive groups such as halogen, alkoxy, alkyl is generally preferred S group. Therefore, the prior art's polymer having the formula [2] teaches the presently claimed repeating unit having the S group.

With respect to present claims 5, 7, 12, 19, 23, and 27, Urano et al teach that the first repeating unit (which corresponds to the presently claimed repeating unit having the S group of claims 8 and 28) of their polymer (b) having the formula [2] can be present in an amount of 10-50 mole % (see pg.12, line 10). This gives 90-50 mole % for the rest of the repeating units, i.e., sum of the repeating units that contain a single-meta hydroxyphenyl group, the repeating units

that contain a single-para hydroxyphenyl group, and the repeating units that contain a butoxycarbonyl group. Since this range of 90-50 mole % overlaps with the presently claimed range of at least about 90 %, the prior art's range would have made the present range *prima facie* obvious. See In re Wertheim, supra.

With respect to present claims 14, 16, 31, and 33, since the prior art teaches their resist material to be coated on a semiconductor substrate such as silicone wafer which is exemplified by applicants, it is the Examiner's position that the prior art teaches the present inventions of these claims.

7. Claims 1-7, 10-27, and 30-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hinsberg et al (EP 0 596 668 A2).

Hinsberg et al teach a polymeric film comprising a vinyl polymer that contains hydroxystyrene and alkyl acrylate and a photoacid generator, and the prior art also teaches a process for generating a resist image on substrate comprising the steps of coating the substrate with the polymeric film, imagewise exposing the film to radiation, and developing the image. See particularly, col.2, lines 39-55, col.3, lines 31-40, col.4, lines 17-29, col.6, lines 4-24, lines 53-54, col.7, lines 10-14, col.8, lines 9-15, lines 52-53, claims 1, 10-11, 14-16.

With respect to present claims 1-2, 10-11, 17, 20, 22, 24, and 34, Hinsberg et al teach that the vinyl polymer of their invention contains hydroxystyrene and alkyl acrylate and further teach that the hydroxystyrene is suitably the para or meta isomer and the alkyl acrylate is preferably *t-butyl acrylate (which is the presently claimed acrylate acid-labile group)*. See col.6, lines 4-24

and claims 10-11, and 15. Therefore, it is the Examiner's position that some of the hydroxystyrene units would have a single para-hydroxy group and some of them would have a single meta-hydroxy group and thus the prior art teaches the present inventions of above claims.

With respect to present claims 3-4, 6, 18, 21, and 25-26, since the present variable n in these claims can be zero (and the present variable m in claim 25 can also be zero), the prior art's polymer containing meta/para hydroxystyrene and t-butyl acrylate units also teaches the present inventions of these claims.

With respect to present claims 5, 7, 19, 23, and 27, since the prior art teaches a copolymer of meta/para hydroxystyrene and t-butyl acrylate to be the preferred copolymer (col.6, lines 4-24) and since that copolymer does not contain any other repeating units, the prior art's copolymer teaches the present inventions of these claims.

With respect to present claims 14, 16, 31, and 33, the prior art teaches (col.7, lines 13-15) that suitable substrates (which is used for the lithographic imaging process for using in the manufacture of integrated circuits) can be silicon, ceramics, or polymer. Since there are only three examples listed for the substrate, it would have been obvious to one of ordinary skill in the art to choose (as a matter of choice) the silicon to be the substrate with a reasonable expectation that the resist image formed on the silicon substrate would work well to produce the integrated circuit. since the prior art teaches their resist film to be coated on a *silicon* substrate which is exemplified by applicants, it is the Examiner's position that the prior art teaches the present inventions of claims 14, 16, 31, and 33.

8. Claims 17-18 are rejected under 35 U.S.C. 102(b) as being anticipated by Watanabe et al (JPO abstract: JP406049137A and DERWENT abstract: 1994-097835 - English abstracts of JP 06049137 A).

The Japanese document JP'137 has been submitted for English translation. Only the English abstracts are available at this time.

Watanabe et al teach (see the English abstracts and the formula (1)-(4) for the repeating units of the polymer shown on pg.2 of JP'137) a polymer containing a para-hydroxyphenyl group, a meta-hydroxyphenyl group, and tert-butoxycarbonyl group (pendant acid-labile group), and the prior art's polymer teaches the present inventions of claims 17-18.

9. Claims 1, 3, 5, and 13-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe et al (JPO abstract: JP406049137A and DERWENT abstract: 1994-097835 - English abstracts of JP 06049137 A) in view of Watanabe et al (5,844,057).

With respect to present claims 1, 3, and 5, although Watanabe et al (JP'137) does not explicitly teach the presently claimed photoresist composition of these claims, the prior art does teach that their polymer is useful as resist material of high resolution for large-scale integrated circuit (*LSI*) (see the English abstracts). Another prior art, Watanabe et al ('057), which teaches a polymer comprising hydroxy-substituted phenyl group (some at meta, some at para position) and acid-labile groups (as discussed in paragraph 5 of this Office Action), teaches a photoresist composition containing the polymer and a photoacid generator (see col.1, lines 5-15 and col.2, lines 8-25). Watanabe et al ('057) teach that the polymer which is used as base resin for their

photoresist composition is suitable as a fine pattern-forming material in the manufacture of ultra-*LSI*'s. Since the polymer of Watanabe et al (JP'137) and the polymer of Watanabe et al ('057) are very similar, and since Watanabe et al (JP'137) teach that their polymer is useful as resist material of high resolution for LSI, it would have been obvious to one of ordinary skill in the art to combine the polymer taught in JP'137 with a photoacid generator and use the composition as a fine pattern-forming material in the manufacture of LSI as taught by Watanabe et al ('057). Therefore JP'137 in combination with Watanabe et al ('057) teach the present inventions of claims 1, 3, and 5.

With respect to present claims 13-16, Watanabe et al ('057) teach (col.19, lines 29-51) that their photoresist composition containing the polymer and a photoacid generator is spin-coated onto a silicon wafer, exposed to actinic radiation, and then developed with an aqueous base solution to form a resist pattern for the manufacture of LSIs. Therefore, it would have been obvious for one of ordinary skill in the art to follow Watanabe et al ('057)'s teaching and to spin-coat the photoresist composition containing the polymer of JP'137 onto a silicon wafer, expose, and then develop to form a resist pattern for the manufacture of LSIs because the polymers taught in both of these prior arts are very similar and the prior art JP'137 teaches that its polymer is useful as resist material of high resolution for LSI. Therefore, JP'137 in combination with Watanabe et al ('057) teach the present inventions of claims 13-16.

10. In their REMARKS, applicants argue that Watanabe ('057) is cited for a report of phenyl groups that have multiple phenyl ring substituents and also cited for a polymer that has acid-

labile groups pendant to a phenyl group. Applicants also argue that Watanabe does not report a polymer that contains a meta-hydroxyphenyl group that is unsubstituted at available ring positions other than by a single meta-hydroxyphenyl moiety.

First of all, the Examiner would like to point out that Watanabe was cited for the polymer having the general formula (3) shown in col.6 of the prior art. In that formula, the second repeating unit contains m number of -OH groups wherein m can be 1, 2 or 3. Therefore, the Examiner disagrees with applicants' argument that the prior art was cited solely for the phenyl groups that have *multiple* phenyl ring substituents. The Examiner cited the prior art's polymer of the formula (3) because m can be 1 as well as 2 or 3.

Secondly, the formula (3) clearly teaches that R5 of the last repeating unit of the formula can be -COOX wherein X can be an acid labile group such as normal, branched or cyclic alkyl groups of 1-6 carbon atoms, and as explained above in paragraph 5 of this Office action, the examples for the normal, branched or cyclic alkyl groups include the t-butyl group. When X is t-butyl group, the last repeating unit of the formula (3) becomes the presently claimed acrylate acid-labile group. Therefore, the Examiner disagrees with the applicants' argument that the prior art was cited for the acid-labile groups pendant to a phenyl group only.

Lastly, as pointed out in paragraph 5 of this Office Action, the second repeating unit of the formula (3) shows that there can be a single (when m is 1) hydroxy group attached to the phenyl ring without the restriction on the position of the hydroxy group. Therefore, some phenyl groups of the repeaing unit can have the single hydroxy group on the meta position while the

other phenyl groups in the repeating unit can have the single hydroxy group on the para position. Therefore, the Examiner also disagrees with the applicants' argument that Watanabe does not report a polymer that contains a meta-hydroxyphenyl group that is unsubstituted at avialiable ring positions other than by a sinle meta-hydroxyphenyl moiety. It is the Examiner's position that the general formula (3) shown on col.6 of the prior art does encompass the polymer presently claimed by applicants.

Applicants' comparative results set forth in the Rule 132 Declaration were carefully considered however found unpersuasive since the comparison was not made to the closest prior art, Watanabe et al. In order to show that addition of a meta-hydroxyphenyl unit to a polymer containing para-hydroxyphenyl units and acid-labile units can favorably impact dissolution rates and solubility differentials between exposed and unexposed regions, it can be suggested that applicants perform experiments comparing (i) a polymer of the formula (3) containing the first repeating unit (since the variable t is positive number which means that the first repeating unit has to be there according to the formula (3)), second repeating unit with only a single para-hydroxy substituent, and the last repeating unit containing the acrylate-acid labile group vs. (ii) a polymer of the formula (3) containing the first repeating unit, second repeating unit some of which has a single para-hydroxy substituent and some of which has a single meta-hydroxy substituent, and the last repeating unit having the acrylate-acid labile group (since the variable r can be zero according to the formula (3), the third repeaing unit is left out). Please see MPEP 716.02 for more details helpful for showing the unexpected results.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sin J. Lee whose telephone number is (703) 305-0504. The examiner can normally be reached on Monday-Friday from 8:30 am EST to 5:00 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ms. Janet Baxter, can be reached on (703) 308-2303. The fax phone number for the organization where this application or proceeding is assigned is (703) 305-3599 for after final responses or (703) 305-7718 for all other responses.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-0661.

S. Lee
July 7, 2000

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